



## GTF2H5 gene

general transcription factor IIH subunit 5

### Normal Function

The *GTF2H5* gene provides instructions for making a protein called p8 or TTDA. This protein is one part (subunit) of a group of related proteins known as the general transcription factor IIH (TFIIH) complex. The TFIIH complex has two major functions: it is involved in the process of gene transcription, which is the first step in protein production, and it helps repair damaged DNA.

DNA can be damaged by ultraviolet (UV) rays from the sun and by toxic chemicals, radiation, and unstable molecules called free radicals. DNA damage occurs frequently, but normal cells are usually able to fix it before it can cause problems. One of the major mechanisms that cells use to fix DNA is known as nucleotide excision repair (NER). As part of this repair mechanism, the TFIIH complex opens up the section of double-stranded DNA that surrounds the damage. The TTDA protein helps with this process by stabilizing the TFIIH complex and maintaining its structure. Once the damaged region has been exposed, other proteins snip out (excise) the abnormal section and replace the damaged area with the correct DNA.

### Health Conditions Related to Genetic Changes

#### trichothiodystrophy

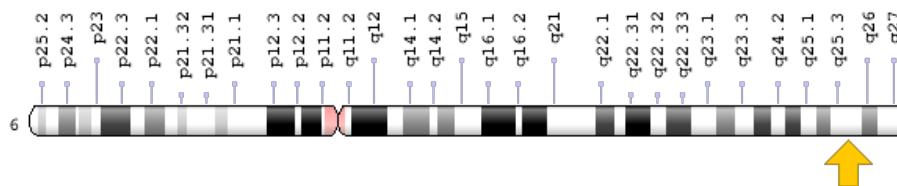
At least three mutations in the *GTF2H5* gene have been found to cause trichothiodystrophy. Mutations in this gene cause the photosensitive form of the condition, which is characterized by an extreme sensitivity to UV rays from sunlight.

Each of the known *GTF2H5* gene mutations results in the production of a nonfunctional version of the TTDA protein. A loss of this protein probably causes the TFIIH complex to become unstable, which greatly reduces the amount of this complex within cells. Without enough of the TFIIH complex, cells cannot effectively repair DNA damage caused by UV radiation. These problems with DNA repair cause people with the photosensitive form of trichothiodystrophy to be extremely sensitive to sunlight. It is unclear how a loss of the TTDA protein leads to the other features of the condition, such as slow growth, intellectual disability, and brittle hair.

## Chromosomal Location

Cytogenetic Location: 6q25.3, which is the long (q) arm of chromosome 6 at position 25.3

Molecular Location: base pairs 158,168,316 to 158,199,344 on chromosome 6 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

## Other Names for This Gene

- bA120J8.2
- C6orf175
- FLJ30544
- general transcription factor IIH, polypeptide 5
- p8
- TF2H5\_HUMAN
- TFB5
- TFB5 ortholog
- TFIIH basal transcription factor complex TTD-A subunit
- TFIIH basal transcription factor complex TTDA subunit
- TGF2H5
- TTD
- TTD-A
- TTDA

## **Additional Information & Resources**

### Educational Resources

- Cancer Medicine (sixth edition, 2003): Steps in Nucleotide Excision Repair (image)  
<https://www.ncbi.nlm.nih.gov/books/NBK13017/?rendertype=figure&id=A5537>
- Madame Curie Bioscience Database: Trichothiodystrophy: A Disorder Highlighting the Crosstalk between DNA Repair and Transcription  
<https://www.ncbi.nlm.nih.gov/books/NBK6285/>
- The Cell: A Molecular Approach (second edition, 2000): DNA Repair  
<https://www.ncbi.nlm.nih.gov/books/NBK9900/>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28GTF2H5%5BTIAB%5D%29+OR+%28TFB5%5BTIAB%5D%29+OR+%28TTD-A%5BTIAB%5D%29+OR+%28TTDA%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

### OMIM

- GENERAL TRANSCRIPTION FACTOR IIH, POLYPEPTIDE 5  
<http://omim.org/entry/608780>

### Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_GTF2H5.html](http://atlasgeneticsoncology.org/Genes/GC_GTF2H5.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=GTF2H5%5Bgene%5D>
- HGNC Gene Family: General transcription factors  
<http://www.genenames.org/cgi-bin/genefamilies/set/565>
- HGNC Gene Family: Nucleotide excision repair  
<http://www.genenames.org/cgi-bin/genefamilies/set/1269>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=21157](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=21157)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/404672>
- UniProt  
<http://www.uniprot.org/uniprot/Q6ZYL4>

## Sources for This Summary

- Coin F, Proietti De Santis L, Nardo T, Zlobinskaya O, Stefanini M, Egly JM. p8/TTD-A as a repair-specific TFIIH subunit. *Mol Cell.* 2006 Jan 20;21(2):215-26.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16427011>
- Faghri S, Tamura D, Kraemer KH, DiGiovanna JJ. Trichothiodystrophy: a systematic review of 112 published cases characterises a wide spectrum of clinical manifestations. *J Med Genet.* 2008 Oct; 45(10):609-21. doi: 10.1136/jmg.2008.058743. Epub 2008 Jun 25. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/18603627>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3459585/>
- Giglia-Mari G, Coin F, Ranish JA, Hoogstraten D, Theil A, Wijgers N, Jaspers NG, Raams A, Argentini M, van der Spek PJ, Botta E, Stefanini M, Egly JM, Aebersold R, Hoeijmakers JH, Vermeulen W. A new, tenth subunit of TFIIH is responsible for the DNA repair syndrome trichothiodystrophy group A. *Nat Genet.* 2004 Jul;36(7):714-9. Epub 2004 Jun 27.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/15220921>
- Giglia-Mari G, Miquel C, Theil AF, Mari PO, Hoogstraten D, Ng JM, Dinant C, Hoeijmakers JH, Vermeulen W. Dynamic interaction of TTDA with TFIIH is stabilized by nucleotide excision repair in living cells. *PLoS Biol.* 2006 Jun;4(6):e156. Epub 2006 May 9.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16669699>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1457016/>
- Hashimoto S, Egly JM. Trichothiodystrophy view from the molecular basis of DNA repair/transcription factor TFIIH. *Hum Mol Genet.* 2009 Oct 15;18(R2):R224-30. doi: 10.1093/hmg/ddp390. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/19808800>
- Kraemer KH, Patronas NJ, Schiffmann R, Brooks BP, Tamura D, DiGiovanna JJ. Xeroderma pigmentosum, trichothiodystrophy and Cockayne syndrome: a complex genotype-phenotype relationship. *Neuroscience.* 2007 Apr 14;145(4):1388-96. Epub 2007 Feb 1. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/17276014>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2288663/>
- Ranish JA, Hahn S, Lu Y, Yi EC, Li XJ, Eng J, Aebersold R. Identification of TFB5, a new component of general transcription and DNA repair factor IIH. *Nat Genet.* 2004 Jul;36(7):707-13. Epub 2004 Jun 27.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/15220919>
- Vermeulen W, Bergmann E, Auriol J, Rademakers S, Frit P, Appeldoorn E, Hoeijmakers JH, Egly JM. Sublimiting concentration of TFIIH transcription/DNA repair factor causes TTD-A trichothiodystrophy disorder. *Nat Genet.* 2000 Nov;26(3):307-13.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/11062469>

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